Image credit: Fever-Tree

Tiny Forest

Monitoring Report 2022

JANUARY 2023

Introduction

The network of 149 Tiny Forests across the UK provides a unique opportunity to examine the environmental and social benefits of urban woodlands. This year, forests all over the country have been monitored by almost 3,500 citizen scientists; a feat that would not have been possible by a small group of professional scientists.

Thank you to all our amazing volunteers and partners for your support in planting, caring for and monitoring your Tiny Forests this year!

This report is structured to showcase the research ambition and initial findings from our five Tiny Forest research topics: biodiversity; flood management; tree growth and carbon storage; thermal comfort; and people and social benefits.

As this is still very early days in the life of a forest continued monitoring is critical to understanding these complex processes. We are really excited that so many of you have started on this research journey with us and look forward to exploring the forests together in years to come. We hope this report gives you a flavour of the interesting questions we will be able to answer as our dataset builds!

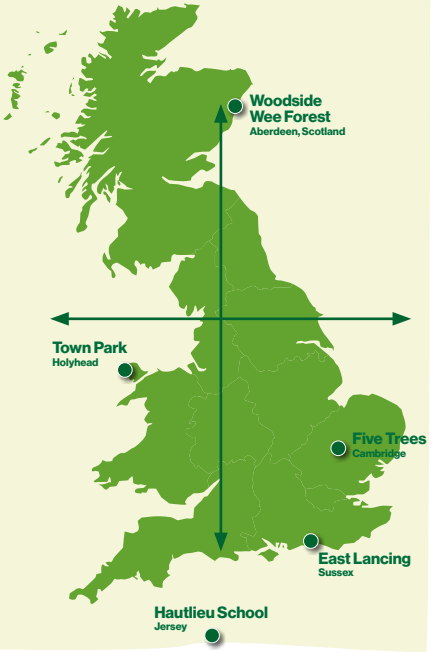
2022 Monitoring Headlines

As of April 2022, communities across the UK have planted

149
Tiny Forests in two years

3,465
citizen scientists
took part in monitoring activities in 2022

80 Tiny Forests were monitored in 2022



There are
89,123
trees and shrubs planted in the 149 Tiny Forests and citizen scientists measured **4,370** of them in 2022

Water is absorbed into the ground **32% faster** inside the Tiny Forest compared to surrounding land

359 biodiversity surveys were completed

Volunteers spent **13,281** mindful minutes recording biodiversity

Two thirds of pollinators recorded were bumblebees, beetles, small insects and other flies

Woodlice, spiders, slugs and snails make up around **50%** of soil dwelling invertebrate groups recorded

Using our tree measurements, we can estimate the total height of all our Tiny Forest trees stacked on top of each other is

7.5 Mount Everests - over 65,800 metres

93%
of participants surveyed felt **refreshed and revitalised** after spending time and doing activities at their Tiny Forest!

In total the 149 Tiny Forests are storing approx.
2.4 tonnes of Carbon
above ground. This is equivalent to 1/4 of one person in the UK's annual carbon footprint

Biodiversity

Over 13,000 mindful minutes recording biodiversity

RESEARCH AMBITION:

How does the number and types of invertebrate groups vary between Tiny Forests and change as the forests grow?

How does surrounding greenspace affect species recorded in the Tiny Forest?

Tiny Forest aims to bring biodiversity rich habitat to urban areas for people and wildlife. By planting a diverse mix of native species of trees and shrubs, Tiny Forest provides food and shelter to a wide variety of species. The biodiversity monitoring surveys explore two groups of animals that perform vital roles in the forest: pollinating insects and ground dwelling invertebrates. These animals can be excellent indicators of the health of an environment.

Why?

Biodiversity is in trouble:

- Many pollinators are in decline so understanding how Tiny Forest can provide valuable habitats for them in urban areas is important.
- Even common and widespread butterfly species have declined nationally by 22% between 1976 and 2020[1] and in urban areas declines have been worse than in rural areas[2].
- The health of urban soils is of increasing concern and soil dwelling invertebrates are important indicators of soil function and ecosystem development.
- Importantly - observing wildlife is fascinating and provides opportunities to pause for a mindful connection with nature!

359 biodiversity surveys have been carried out across the Tiny Forest network in 2022 through Science Days led by Earthwatch scientists, and independently by our volunteers and Tree Keepers during our first Biodiversity Week in May.

1. UK Biodiversity Indicators 2022 : jncc.gov.uk/our-work/ukbi-c6-insects-of-the-wider-countryside/

2. Dennis, E.B., Morgan, B.J., Roy, D.B. and Brereton, T.M., 2017. Urban indicators for UK butterflies. Ecological Indicators, 76, pp.184-193. https://doi.org/10.1016/j.ecolind.2017.01.009

The vast majority of Tiny Forests are still only in their first or second growing season so results did not vary much between forests, which is not surprising as the habitat and resources for pollinators have not changed much over this time. As flowering trees and other plants develop, resources for pollinators and butterflies will change, and we will see some groups increase and others decrease.

Woodlands are particularly important to some pollinators such as bumblebees and butterflies as the complex structure provides a safe refuge year-round. Overall, Tiny Forests have already dramatically improved resources for wildlife by increasing the diversity of plants and trees for food, shelter and nesting sites, when compared to the habitat of sites prior to planting (typically amenity park grassland).

Butterflies

Butterflies were surveyed in **43 Tiny Forests**. In total, citizen scientists completed **117 surveys** recording **19 different species**.

Small white butterfly

Large white butterfly

TINY FOREST BUTTERFLY SIGHTINGS IN 2022

Table 1:

TOP BUTTERFLY SPECIES

1st place	2nd place
SMALL WHITE	LARGE WHITE
36% of TF (15)	*31% of TF (13)*

These are two of the most widespread generalist butterfly species in the UK. However, in urban areas large white butterflies declined more than in rural areas between 1980 and 2014 and this species is vulnerable to drought. High-quality urban greenspaces like Tiny Forest could be important, helping even common species from further decline.

OTHER TOP SPECIES SPOTTED:

RED ADMIRAL
14% of TF (6)

Previously considered a migratory species, recolonising the UK each year from southern Europe or North Africa, red admiral is increasingly found here during the winter months.

BRIMSTONE
12% of TF (5)

Caterpillar foodplants for Brimstone include Buckthorn and Alder Buckthorn which are both regularly planted in Tiny Forests.

SKIPPER SPECIES
12% of TF (5)

Skipper butterflies are tricky to distinguish between species, but the most common small and large skippers both like areas of long grass so may be seen less frequently as Tiny Forests grow and the canopy closes.

MEADOW BROWN
7% of TF (3)

One of the most abundant butterfly species in many habitats. Adults even fly in dull weather.

In 2022, small and large white butterflies were the most common species spotted in Tiny Forests of all ages (1, 2, and 3 years old). Conversely, small tortoiseshell and ringlet were only recorded in forests in their first growing season (planted in 2021/22) and orange-tip butterflies were only reported in the older forests (Table 1).

Butterfly species recorded in Tiny Forests will also be influenced by the surroundings – in the coming years research will explore how much greenspace there is around our Tiny Forests and how well connected our forests are. For instance, sightings of orange-tip butterflies in the older forests could be due to the location of these particular forests in relation to other suitable habitat – this species prefers damp habitats and feeds on wild garlic or lady's smock, whereas ringlet and small tortoiseshell butterflies favour bramble and wild privet among other flowering plants.

Pollinators

Identifying pollinating insects to species level can require specialist knowledge, so the survey we use in Tiny Forest follows the methodology of the **Pollinator Monitoring Scheme FIT Counts**[3], allowing citizen scientists to record broad groupings of insects – **bumblebees, honey bees, hoverflies, wasps and flies**.

Tiny Forest citizen scientists surveyed pollinating insects in 48 Tiny Forests completing 151 surveys. All 10 different groups of pollinating insects in the survey were recorded across our Tiny Forests (Beetles (larger than 3mm), bumblebees, butterflies and moths, honeybees, hoverflies, 'other flies', 'other insects', small insects (less that 3mm), solitary bees and wasps).

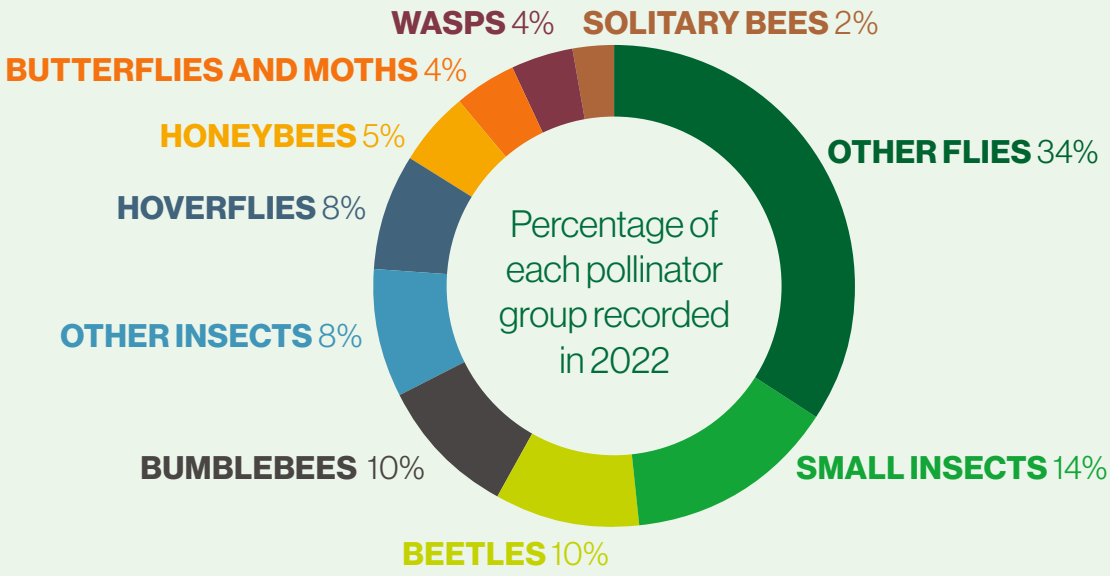
1,526 individual insects were counted! This means that each survey counted about 10 insects which is the same as found from surveys of other habitats (gardens, roadside verges and hedgerows) from FIT Counts across the UK in 2020[4]. In general, these insects came from four different groups however, in five Tiny Forests lucky participants observed eight different groups!

The most common and numerous groups recorded in Tiny Forest this year were 'other flies' (in 85% of the surveyed forests). Small insects, bumblebees, hoverflies and larger beetles were found in 55-60% of surveyed forests and were the most numerous pollinator groups counted (Figure 1). There was no clear difference between the number of insects or the groups recorded between forests that are 1 and 2 years old.

FIT Count surveys from across the UK in the other habitats mentioned above found the most commonly observed groups to be bumblebees, honeybees, hoverflies, other flies and 'small' insects but these varied depending on the flowering plant observed during the survey. Next steps for Tiny Forest pollinator surveys include consideration of surrounding habitat and connectivity of greenspace, and further aligning methods with the FIT Counts so results can be more easily compared.

Two thirds of pollinators recorded were bumblebees, beetles, small insects and other flies

Figure 1 : Percentage of each pollinator group recorded in 2022



3. UK Pollinator Monitoring Scheme ukpoms.org.uk/fit-counts
4. UK Pollinator Monitoring Scheme Progress Report 2020 ukpoms.org.uk/sites/default/files/pdf/PMRP%20Progress%20Report%20October%202020_final.pdf

Ground Dwellers

Soils are enormously important and diverse – it is estimated that **40% of the total species on earth** make their homes in the soil![5] While most of these are microscopic organisms, larger invertebrates that can be seen with the naked eye (known as macroinvertebrates) have diverse and fascinating roles to play in soil health and function.

Our Tiny Forest surveys focus on surface dwelling soil invertebrate groups because they are excellent indicators to assess soil health. Soil invertebrates in natural forests vary depending on a number of factors. As communities of soil invertebrates develop in Tiny Forest we expect to see more predatory invertebrates which feed on other smaller insects and more beetles reliant on dead wood or fungi, so we expect you to be counting more millipedes, woodlice and centipedes in years to come.

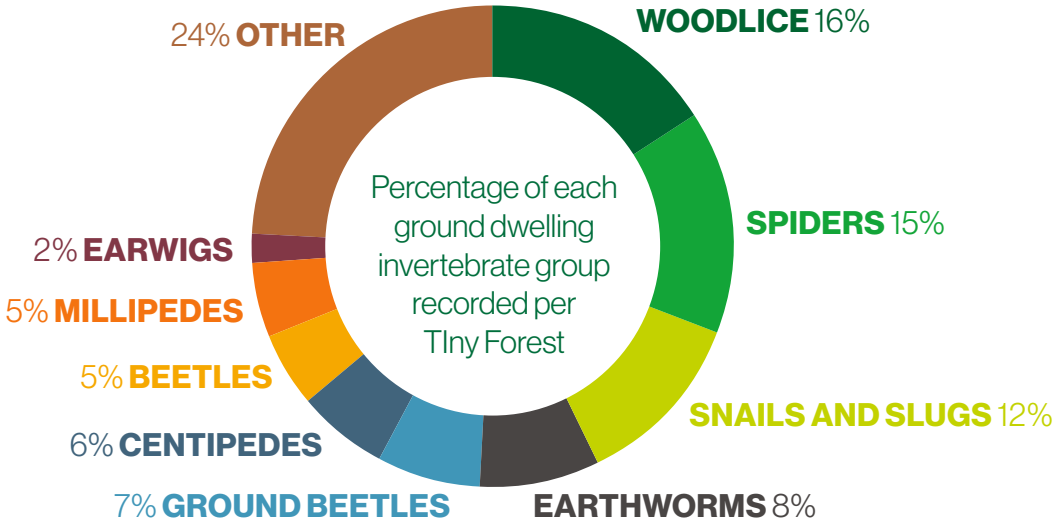
Like the pollinators, identification of species is complex, so we focus on species groups including ecosystem engineers; e.g. ants and earthworms as well as decomposers; e.g. woodlice and millipedes.

When a Tiny Forest is planted, biodiversity tiles are installed which can be lifted up carefully to record the ground dwelling invertebrates living underneath – 91 biodiversity tile surveys were submitted this year from 67 Tiny Forests. Results are calculated by averaging counts across all tiles in each forest surveyed.

On average between 6 and 7 ground dwelling groups were recorded under tiles in each forest. The most numerous species and frequently encountered species groups recorded were ants (84% Tiny Forests), closely followed by spiders (82%) and slugs and snails (61%). Other common groups found in around half of Tiny Forests were ground beetles (55%), woodlice (54%), larvae (52%), centipedes (51%) and earthworms (49%). The least recorded groups were millipedes (28%) and earwigs (19%).

Excluding the ants and larvae which were present in really high numbers, Figure 2 shows that, in terms of abundance, woodlice, spiders, slugs and snails make up around 50% of ground dwelling groups counted (Figure 2). While this is the general pattern that we have observed it will be interesting to explore why some forests varied from this – what is different about the forests where these groups were not the most numerous species recorded?

Figure 2 : Percentage of each ground dwelling invertebrate group recorded per Tiny Forest



5. Orgiazzi, A., Bardgett, R.D., Barrios, E., Behan-Pelletier, V., Briones, M.J.I., Chotte, J.L., De Deyn, G.B., Eggleton, P., Fierer, N., Fraser, T. and Hedlund, K., Global Soil Biodiversity Atlas. Luxembourg: European Commission Publication Office of the European Union; 2016.

As Tiny Forests grow and the soil improves, we expect to see increases in the types and number of species groups - there is a slight indication of an increase in the number of species groups reported from the older forests (those that have been planted more than 1 year ago) (Figure 3). In a study of urban greenspaces in London[6] researchers have shown the presence of leaf litter was the best predictor of ground dwelling invertebrate species density, so as leaf litter develops in a Tiny Forest we would expect to see groups such as earthworms, millipedes, centipedes, woodlice and ants increase.

We will be exploring through our own research, student projects and through collaboration with other researchers how factors such as the availability and connectivity of other habitat types influences the number and the types of soil invertebrate groups that are recorded.

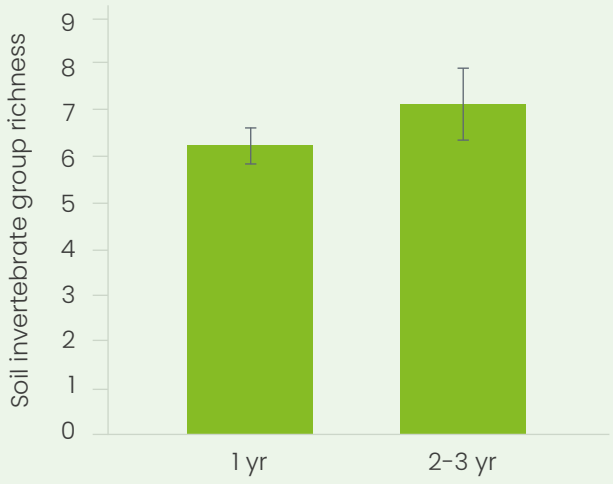


Figure 3: Average number of soil dwelling invertebrate groups (+/- standard error) recorded in Tiny Forests planted 1 year ago compared to those planted 2 or 3 years ago.

6. Smith, J., Chapman, A. and Eggleton, P., 2006. Baseline biodiversity surveys of the soil macrofauna of London's green spaces. Urban Ecosystems, 9(4), pp.337-349. DOI 10.1007/s11252-006-0001-8

Flood management

Planting a Tiny Forest results in a 32% quicker rain water infiltration in the soil.

RESEARCH AMBITION:
What is the potential capacity of Tiny Forests to store water by changes to soil quality and improving permeability as the forests grow?

How does this compare to surrounding soils?

Flash-flooding is becoming an increasingly frequent issue, caused by extreme or prolonged rainfall. The effects of this type of flooding are worsened in urban environments, where impermeable surfaces cover the ground and lack of trees causes increased water runoff. It is well documented that trees can help reduce the risk of flooding. Trees intercept rainfall before it reaches the ground which slows water flow and their root network make soils more permeable which helps water infiltrate deeper into the soil.

To assess the benefits Tiny Forests can provide to flood management, surveys were conducted by citizen scientists on water infiltration, soil texture and soil compaction. These surveys are conducted inside and outside the forest. Results from outside the forest are a control representing what the soil conditions would have been had the forest not been planted. This allows us to evaluate the impact of a Tiny Forest on soil conditions.

Water infiltration

Infiltration is the process whereby water is absorbed into the soil. The rate of infiltration is directly affected by the permeability of the ground cover, and impacts the accumulation of water on the soil surface, which in extreme conditions can result in flooding.

Tiny Forests infiltration rates are determined by measuring the length of time taken for 450ml of water to fully infiltrate the ground within a pipe inserted into the soil.

A total of 303 infiltration surveys were submitted this season, across 58 Tiny Forests in the UK. 232 measurements were taken inside the Tiny Forests and 71 outside the Tiny Forests, which allows us to evaluate the impact of a Tiny Forest on the immediate area.

On average surveys showed that water infiltrated quicker inside the Tiny Forest than outside (Table 2).

	THIS SEASON (2022)	DIFFERENCE
Inside	2mins 24sec	32% faster
Outside	3mins 31sec	

Table 2 : Average water infiltration rates inside and outside Tiny Forests showing the effect of planting a Tiny Forest versus the situation if a forest were not planted in the area.

To date there are no differences in infiltration rate between forests planted one or two years ago. There are only two Tiny Forests that are three years old where surveys were conducted so the sample size is too small to draw firm conclusions, however, the data we do have indicates that infiltration was as much as 60% faster inside the forest. Take part in monitoring next year to see whether or not we observe ongoing improvements in infiltration rates as our forests grow.

Soil texture

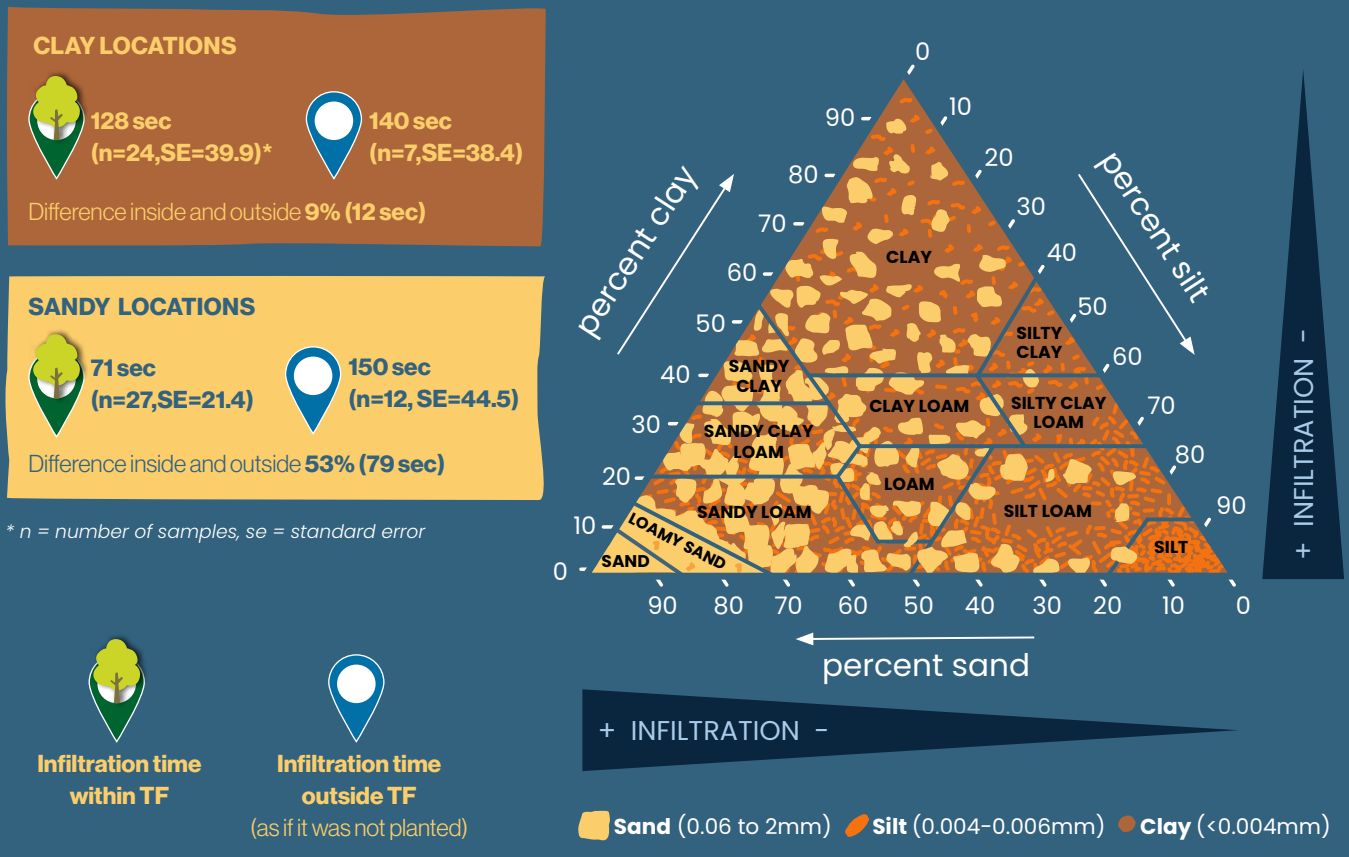
Soil texture describes the proportion of sand, silt and clay sized particles (Figure 4). Water infiltration within the Tiny Forest is affected by the different soil types; clay soils are much less permeable for water while in sandy soils water can more easily infiltrate through the soil.

Tiny Forest citizen scientists from across the UK have identified 11 different soil types, getting their hands dirty assessing soil texture and colour! This year the most monitored Tiny Forests were in areas with a Clay Loam soil type.

When we compare Tiny Forests within sandy areas against those within clay areas we found that inside the forest our sandy sites on average have a faster infiltration rate than clay. As seen in Figure 4, sandy soil is almost 50% quicker than clayey soil. It also shows Tiny Forests in sandy soils currently have the largest infiltration potential, demonstrated by the biggest difference between samples inside and outside the planted area.

Our clayey Tiny Forest sites on average have a slower infiltration time, this is because clay soil has limited space for water unlike other soil types.

Figure 4 : Infiltration rates vary by soil texture across Tiny Forests



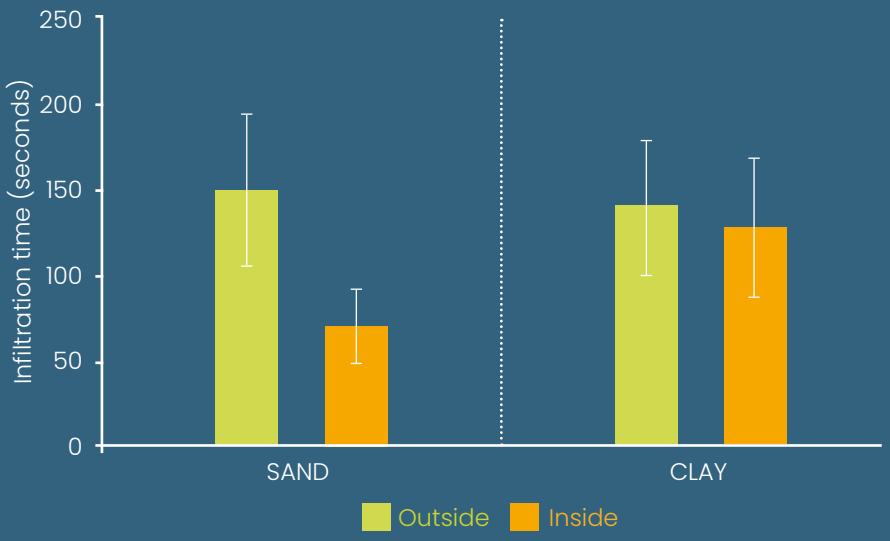


Figure 5 : Average infiltration time inside and outside the Tiny Forest in sandy and clayey soils

Despite no statistically significant difference between infiltration time inside the forest between the Tiny Forests in clay and sand areas, these results are still collected from very young forests. We would expect clay soils to change over a longer time, with sustained effects.

Soil Compaction

Loose soil allows water, nutrients, air and roots to move easily through the soil. Compacted soils have restricted water holding capacity which causes water to accumulate on the surface and increases flash-flood risk.

Soil compaction was measured in and around the Tiny Forests using a penetrometer, which measures the pressure taken to penetrate the soil (kg/cm^2). The soil compaction gives us an idea of how easily the tree saplings can root, and how easily the water can infiltrate through the soil. A total of 311 surveys were conducted on compaction; 230 surveys measured compaction inside the forest and 81 outside the forest.

Overall, soil compaction after planting a Tiny Forest is lower than the unplanted area around the forest, as demonstrated in Figure 6. On average the compaction inside a forest is measured at 1.61 kg/cm^2, compared to an outside compaction of 2.51 kg/cm^2. This suggests that planting a Tiny Forest positively effects soil which potentially reduces the flash-flood risk at the site. Although these changes are a result of our pre-planting soil treatment this trend is predicted to become more evident over time, and become stronger as the forests' root system develop.

Over time the forests' natural cycle will aid in the gradual improvement of the forest soils; decomposition of organic matter within the forest such as dead wood and leaf litter will improve soil structure, compaction and nutrients levels. As the forests mature their root network will help relieve soil compaction, in turn improving soil infiltration and contribute to reducing flash-flood risk. By taking part in Tiny Forest monitoring you can help us understand this process and see the potential for Tiny Forest as a nature-based solution as your forest grows.

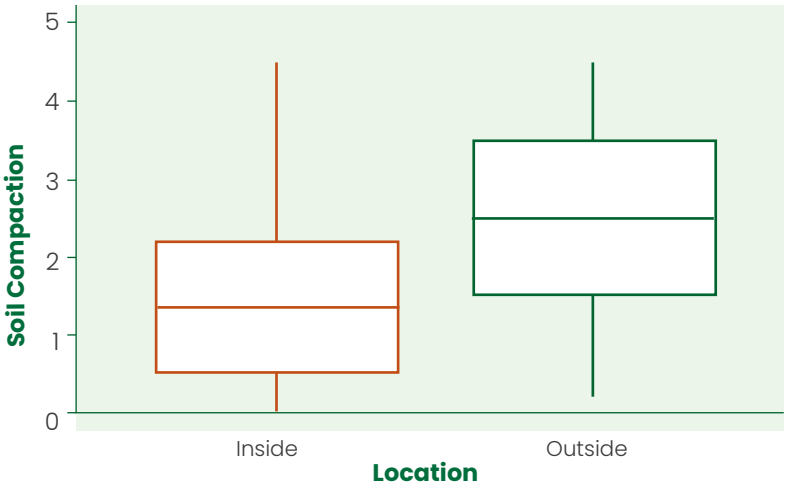


Figure 6 : Differences in soil compaction at forests during their first year (288 samples, 211 inside Tiny Forest and 77 outside planted area)

Tree growth and Carbon

Image credit: Tree Keeper Paul Salman

There are 89,123 trees planted in the 149 Tiny Forests, with a total height of 7.5 Mount Everests - over 65,800 metres.

RESEARCH AMBITION:
How does tree growth and carbon storage vary across the Tiny Forest network annually?

How does this vary by tree species and forest layers?

Trees store carbon in their woody parts and are increasingly viewed as an important part of the solution to help tackle the climate crisis. At Earthwatch, we want to understand how the Tiny Forest method of tree planting (developed in Japan by Dr. Akira Miyawaki)[7], effects tree growth . This is important because as trees grow they store carbon in their trunks, branches and roots. This is called the tree's biomass. The amount of carbon stored in a tree is proportional to its biomass, which increases with its diameter, height and canopy spread.

How do we calculate the above ground biomass and stored carbon of the forests?

On a planting day, we tag 100 of the 600 trees in each Tiny Forest with numbers from 1-100. The forest's trees are tagged in proportion to its species composition and structure.

During the Tiny Forest carbon storage survey, citizen scientists locate as many of these tagged trees in their Tiny Forest as they can find, and measure the height and diameter of the trees' main stem. This information is then used to calculate an estimate of the above ground weight of the tree i.e. the green weight (GW = constant x height x diameter^2). Green weight relates to the total mass of a tree when it is alive, including all the water and woody content. Experiments have shown that about half the weight of a tree is water and so to calculate the weight of a tree without water we multiply the green weight by 0.5 to get the dry weight (DW = GW x 0.5). Finally, we estimate the amount of carbon stored in the woody mass of the tree. Experiments have shown this is about half the dry weight of a tree (C = DW x 0.5).

7. To read more about the Miyawaki method and Tiny Forest see our recent article in the Quarterly Journal of Forestry https://zenodo.org/record/7053895#.Y5cYHHbP2Uk

Based on data collected in 2022, Tiny Forest has stored a total of approximately 2.4 tonnes of carbon above ground. This is equivalent to 1/4 of the annual carbon footprint of one person in the UK. Trees also store carbon in their roots. As such, our calculation of carbon stored in Tiny Forest is an underestimate as it doesn't take into account the carbon stored in the roots of the trees. It is clear that global transformational changes and large-scale solutions are essential to combat the climate crisis but Tiny Forests are young and will continue to store more carbon as they grow.

Tiny Forest's research aims to further our understanding of Miyawaki forests. Using the carbon survey, collaborating with researchers, and employing citizen science methods across forests planted using other methods, we will be able to explore the factors that impact tree growth in Tiny Forests and assess growth rates compared to traditional forestry methods. We have set up a comparative study and will start collecting data next year.

Since 2021, the Tiny Forest Carbon Storage survey has been completed 5,694 times at 73 Tiny Forests, measuring 49 different tree species. The most common species planted in Tiny Forest is the Small-Leaved Lime, a slow growing canopy tree. Tiny Forests are composed of layers: Canopy (44% of the forest), sub-canopy (17%), understory (29%), and shrub layer (10%). The results show that in the first-year, forest layers contribute relatively equally to above ground biomass. Whilst, in year 2, the above ground biomass contribution of the forest layers is more similar to the planting ratios.

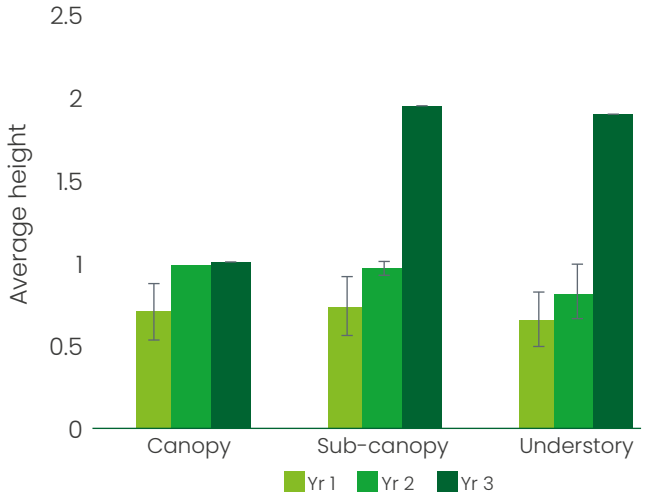


Figure 7 : Average height in metres (± standard deviation) of trees in three canopy layers (canopy, sub-canopy, understory) in Tiny Forests during their first, second, and third growing season.

TALLEST TREE:
Goat Willow
425cm
Tychwood, Witney
3 years old

THICKEST STEM:
Goat Willow
65.8mm
Tychwood, Witney
3 years old

THINNEST STEM:
31 trees
1mm
11 forests
aged 1, 2 and 3 years old

LARGEST TREE (GW – above ground biomass):
Alder, 39kg
Nant-y-moel, Bridgend
2 years old

SMALLEST TREES:
2 English Oaks and 1 Blackthorn
5cm
Queensmead Playing Field, Leicester ; The Delph, Wirral; Emu, Langdale Recreation Ground
1 year old

MOST COMMON SPECIES MEASURED:
English Oak

Thermal comfort

RESEARCH AMBITION:
Do Tiny Forests have a cooling effect? Do local microclimate conditions differ within the Tiny Forest compared to urban surroundings and how do people perceive these differences in terms of thermal comfort?

Cities and built-up areas behave as 'urban heat islands', with higher temperatures than nearby rural landscapes. This is increasing due to global warming and research by the Met Office estimates that British cities could be 10°C hotter than rural areas by 2100. This not only makes living in urban areas more uncomfortable in the summer, but can also cause serious health effects through worsened air pollution and heatwave events.

Increasing green spaces and trees (like Tiny Forests!) in urban areas have been shown to lower urban temperatures in summer. Therefore, the planting of trees in urban spaces is an excellent adaptation strategy to cool our warming cities.

Thermal comfort is a term that describes how satisfied individuals feel, in regards to their thermal state; essentially how hot or cold they feel. Physical weather conditions, behavioural and psychological factors can contribute to the perception of thermal comfort. Recent research has suggested that trees in urban areas effect both the physical microclimate and the perception of an individual's thermal comfort.

We want to understand the effect of Tiny Forests on residents' thermal comfort. Tiny Forest citizen scientists did this by recording weather station data for temperature, humidity and windspeed and describing their personal perception of the climatic conditions (their thermal comfort), both inside and outside the Tiny Forests.

Tiny Forest citizen scientists took a total of 4,086 measurements; 681 samples for each of the six different metrics of thermal comfort.

Despite this amazing effort no consistent trends could be discerned from the data. There was a small indication that more people felt comfortable in older (and therefore taller) Tiny Forests. 59% of citizen scientists reported feeling a comfortable temperature in older forests, compared to 46% in the most recently planted sites.

This is probably because the Tiny Forests are still too young! This was expected because most of our trees are not much higher than a metre tall.

Research has shown that trees provide a cooling effect that increases with age, height and canopy size, as such when the Tiny Forests grow taller, we expect to see lower temperatures and higher humidity. These effects are as a result of tree canopy shading and the transpiration of water from tiny holes (known as stomata) in the leaves of trees.

As both the forests and datasets grow, it will be interesting to explore how Tiny Forests effect thermal comfort. We look forward to exploring the data you have collected next season, when we will have more than 20 forests of the same age.

Photo credit: Fever-Tree

Social

90% of participants surveyed felt more calm and relaxed in the Tiny Forest

Photo credit: Hinckley & Bosworth Borough Council

RESEARCH AMBITION:
What is the social reach of Tiny Forest – does the scheme help a diverse range of people to engage with this place-based greenspace intervention?

To what extent does participation in Tiny Forest improve people's 'connection to nature'?

There is growing research to suggest that people are facing 'extinction of experience' or disconnect with the natural world, which can have adverse impacts on health, wellbeing and efforts to conserve the planet. The Government's 25 Year Environment plan[8] includes targets to help reconnect people with nature however, to determine the success of current greening schemes we must understand the current level of connectedness felt between local communities and their green surroundings.

Tiny Forest aims to provide improved access to high-quality green space particularly in areas of multiple deprivation. To assess this, social surveys are being gathered across the Tiny Forest network from our volunteers and partners. Tiny Forest volunteers have also shared highlights of what they have been getting up to connecting with nature in their Tiny Forest.

8. https://www.gov.uk/government/publications/25-year-environment-plan

90%
of participants surveyed said the Tiny Forest made them feel **calm and relaxed** (88% in national Monitor of Engagement with the Natural Environment survey)*

* MENE Natural England's Monitor of Engagement with the Natural Environment

93%
of participants said the Tiny Forest made them feel refreshed and revitalised (90% in national MENE survey)

97%
of participants said they felt close to nature

98%
of participants using the Nature relatedness scores (80) had a score greater than 3 showing they already had a strong connection to nature which is related to how much people care for and act to protect the environment.

Access to good quality greenspace is not felt equally across the population with inequalities apparent between different age, ethnic and socio-economic groups. Indeed, as social deprivation increases, access to greenspace decreases and time spent outdoors also declines. Earthwatch and our partners want to ensure Tiny Forests are for everyone and seek, where possible, to plant Tiny Forests in areas of multiple deprivation. To date, 50% of Tiny Forests in England are planted in areas of high deprivation - 63 of 125 Tiny Forests in England planted in the most deprived 30% of areas* nationally as measured by the Index of Multiple Deprivation IMD 2019. The IMD is a measure of relative deprivation across seven areas considered essential to life, society, living well and growing up well. These include income, employment, education, health, access to services, crime and living environment.

**Areas = local authority areas and smaller areas within each authority known as Lower Layer Super Output Areas (LSOAs)*

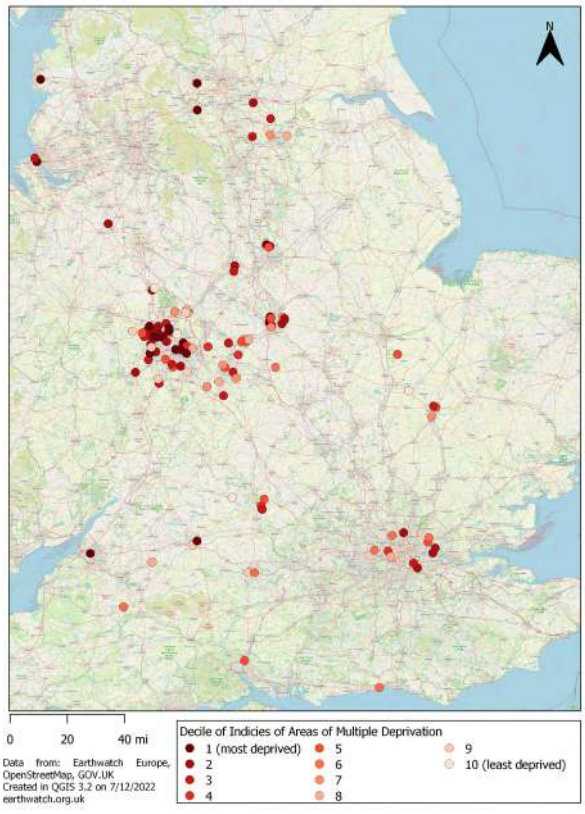
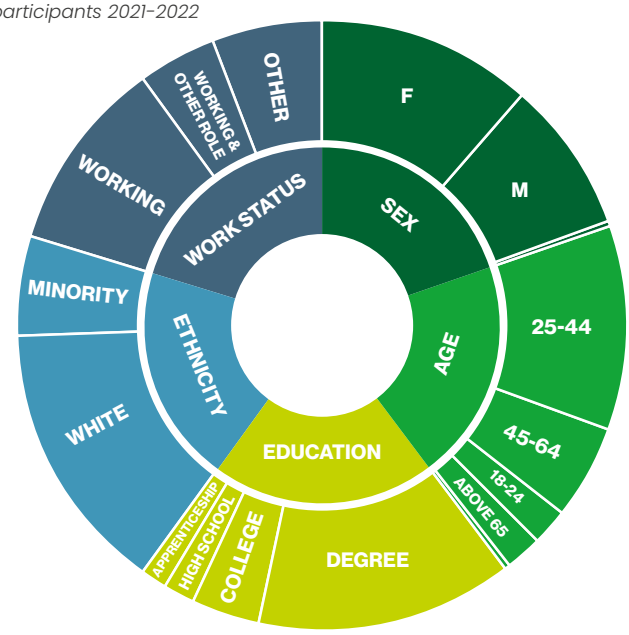


Figure 8. Location of Tiny Forests in England colour coded by the Index of Multiple Deprivation for their local area

We've been collecting data from participants over the last two years building our understanding of the diversity of Tiny Forest participants. To date 73 participants have been surveyed at 11 Tiny Forests in 2021 and 2022. Thanks to participants, Earthwatch Europe staff, volunteers and MSc student Ayesha Carew for helping with this important research which we will continue to build on in coming years.

Figure 9: Socio-demographic groupings of Tiny Forest participants 2021-2022



Tiny Forest participants represent a diverse mix of backgrounds and ages (Figure 9) but there are some factors which are interesting to note. The most common demographic was white, female, aged between 25 and 44, with a degree and currently employed. More people (58%) identified as female than male (40%) than would be expected from the national population (51% female, 49% male). In terms of ethnicity Tiny Forest participants reflected more diversity than the national population with 26% of people identifying as black, Asian or minority ethnic groups compared to 15% nationally.

We continue to look at ways to increase diversity in the Tiny Forest project through forest location and engagement across local groups.

9. Indices of Multiple Deprivation 2019 https://data-communities.opendata.arcgis.com/datasets/communities::indices-of-multiple-deprivation-imd-2019-1/explore?location=52.800440%2C-2.489783%2C7.84

"The time at the forest, for me was therapeutic - just what I needed"

- Tree Keeper Sarah, after a bit of weeding and carbon surveying with Tree Keeper Ian during Carbon Week.

Quote and photo credit Tree Keeper Sarah McKenzie, Frank Bott Avenue Tiny Forest, Crewe.

"Carbon measuring week got off to a good start at Monkton Park, Chippenham today, about 40 trees measured and lots of wildlife spotted".

Quote and photo credit Tree Keeper Melanie Boyle, Monkton Park Tiny Forest, Chippenham

Ric and Phil measuring trees with a bit of help from Arnie alongside a good clump of shaggy mane fungus.

Photo credit Tree Keeper Jane James, Oak Street Tiny Forest, Wolverhampton.

Innovative technique by Cambridge 'Five Trees' Tree Keepers doing their carbon survey: they used a string line pulled across the fencing to keep track of where they had got to in the forest. They worked along the line to check for tags on trees, and then moved it forwards over trees once they'd been surveyed/didn't need surveying.

Photo and explanation credit Tree Keeper Andrew Featherstone, Five Trees Tiny Forest, Cambridge.

‘Moonlight carbon survey’ by the Tree Keepers of Mutton Brook Tiny Forest, Barnet, London.

Photo credit Tree Keeper Paul Salman

Carbon survey and community weeding by the Tree Keeper team at Normand Park Tiny Forest, London.

Photo credit Hammersmith & Fulham Council

Biodiversity photos by Tree Keeper Alison Calcott at the Kilmarnock Kennedy Drive Wee Forest

Biodiversity photos by Tree Keeper Lucy Na, Thamesmead Tiny Forest, London.

Tree Keeper Helen Stokes enjoying the ant tunnels, larvae and other creepy crawlies with her son at the Queen's Park Tiny Forest, Hinckley.

Photo credit Helen Stokes

Tree Keeper Helen Viner organising a community event to record the biodiversity in the Tiny Forest in Egford park, Frome.

Tiny Forest "gadget man" Chris Wallace, Tree Keeper and Bristol Tree Forum member.

Chris has been developing, testing and building low-cost soil moisture and temperature sensors which will be deployed in a Tiny Forest to measure the physical properties of Tiny Forest soils and compare these with soils outside of the forest. Data will be available to view remotely on a bespoke **dashboard where you can already see data from trees around Bristol**. Look out for more news on this exciting remote monitoring project.

Thank you to all the other Tree Keepers who haven't shared photos, or their stories but are silently beavering on, nurturing their Tiny Forests and collecting vital scientific data!

Why do people come along to Tiny Forest events?
This is what you told us...

How did people feel after they had spent time at a Tiny Forest?

"Very content, happy, inspired and feel I learned something. I want to know/do more"
Science day volunteer

"It was a very enjoyable morning, I learnt a lot and the Earthwatch people were very friendly and helpful"
Science day volunteer

"It felt nice playing with the mud!"
Teddy - Science day volunteer

"I'm happy that I get to be here in nature "
Science day volunteer

"Felt like I made a difference and I did something meaningful"
Ashwan - Science day volunteer

How can I get involved and what's next for Tiny Forest research?

We will continue to build on this research each year to better understand the benefits a Tiny Forest can provide for people and the environment. We have published our first article in the Quarterly Journal of Forestry (Cardenas *et al.* 2022[10]) outlining the Tiny Forest approach and research ambitions.

This year we have set up a Miyawaki Research Network bringing together organisations and individuals interested in the research aspect of the Miyawaki methodology. It will provide a space to share expertise, develop consistent methods for data collection and support collaboration to maximise our understanding on the growth rate and environmental impacts of this planting methodology.

There are many ways volunteers can get involved:

- **Join in with Biodiversity Week (20 – 28 May 2023) and Carbon Week (16 – 24 September 2023)** - information will be posted on the Tiny Forest portal: **tinyforest.earthwatch.org.uk**
- **Come along to a local science day** to meet Earthwatch scientists and be trained as a citizen scientist. All public events are posted on our Eventbrite page: **bit.ly/3B7lDHe**
- **Become a Tree Keeper** and join a fabulous community of over 400 Tiny Forest champions! Email us at **tinyforest@earthwatch.org.uk** to learn more.
- **Run your own fun community science day** in your Tiny Forest! Attend our skills training to gain confidence, learn from your peers through our Tree Keeper network, and borrow our citizen science kit to run your own Tiny Forest citizen science event!
- **Talk about your Tiny Forest in your local circles**. Some of our Tree Keepers are already talking about taking 'climate action through citizen science' at their local sustainability events. You can do this too. We are here to help you with resources you might need!
- **Invite your local school / scouts / guides group to monitor the Tiny Forest**. Tiny Forests are living, breathing science laboratories and are amazing assets for teachers and pupils. Talk about the benefits of Tiny Forest citizen science at PTA meetings, and parents' groups. Have a look at our education website to learn more **edu.earthwatch.org.uk** . This is also a wonderful resource for home-educators and teachers.
- **Use your local Tiny Forest as an outdoor venue!** Write eco-poetry, tell stories, create a mandala with the fallen leaves and twigs, sketch botanical drawings, make this space your own. And while you are at it, invite more people to join you!

For more information visit **tinyforest.earthwatch.org.uk**
or get in touch with us at **tinyforest@earthwatch.org.uk**

10. Cárdenas, Macarena L., Pudifoot, Bethany, Narraway, Claire L., Beumer, Victor, & Hayhow, Daniel B. (2022). Nature-based Solutions Building Urban Resilience for People and the Environment: Tiny Forest as a case study. Quarterly Journal of Forestry, 116(3), 173–183. https://doi.org/10.5281/zenodo.7053895

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NatureScot

OVO Foundation

Peabody

Severn Trent Water

Siemens

Shamita Ray

The Guinness Partnership

The Mather Family Charitable Trust

The WFH Foundation

Vaillant Group

Whyte & Mackay

Landowner partners:

Barnsley Metropolitan Borough Council

Birmingham City Council

Blackpool Council

Bowling Park Primary School

Bradford Council

Bristol City Council

Cambridge City Council

Cambridgeshire County Council

Charnwood Borough Council

Chippenham Town Council

City of Wolverhampton Council

Doncaster Council

Eastleigh Borough Council

Frome Town Council

Glasgow City Council

Hinckley & Bosworth Borough Council

Hobbayne Primary School

Keep Wales Tidy

Kirklees Council

Lancing Parish Council

Leicester City Council

Lewisham Council

London Borough of Barnet

London Borough of Hammersmith and Fulham

London Borough of Redbridge

Oxford City Council

Nottingham City Council

Peabody

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